

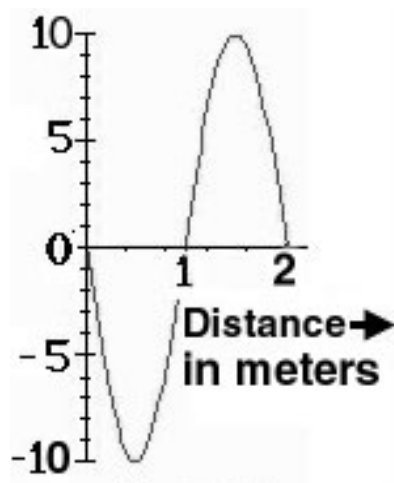
## **Adventures in Sound**

### **Teacher Background Information (SC020300)**

Sound is a form of mechanical energy that results in the vibration of matter. To make a sound, matter must vibrate—move back and forth—so sound can only travel through matter. There is no sound in outer space or in a vacuum. Sound travels better through solids and liquids than through gases.

Sound is described in three ways: amplitude (volume), pitch (the frequency or speed of the vibration), and quality (the regularity of the vibration). This unit covers volume and pitch in a formal way, but there will be many opportunities to discuss the quality of sound as children make their own music.

Amplitude is how much force is used to make the vibrations.



A graph of sound often looks like this: It can be understood by thinking about how many particles of air are in a certain space. When an object vibrates, it squeezes a lot of particles in a small space (a compression), and then the next space has very few particles, then more particles again. (Think of an accordion pleat.) These periodic compressions constitute a vibration. The closer the compressions, the higher the frequency or pitch of the sound. (Something that vibrates faster makes a higher pitch of the sound.)

The volume of the sound is shown by the height of the graph. It reflects how much the air is compressed—what difference there is between the number of particles in a space when the air is compressed and when it is spread out. If your instrument vibrates with more energy (you hit or pluck it harder) you produce a louder sound.

The quality of sound is how regular (even) it is. A good instrument vibrates at the same frequency every time you hit it the same way. A good singer can keep vocal cords vibrating at the same speed for some time—hold a pitch. Bad music is irregular; the pitch moves up and down in an irregular manner. Our ear can't predict what it will hear, so that is less pleasing.

A very good instrument produces several kinds of vibrations at the same time. When they are compatible (when the mathematic ratio between the different vibrations is just right) we say that there is harmony.



In science, we often demonstrate sound with tuning forks. These instruments are all designed to vibrate at very specific frequencies. If you look carefully at the tuning fork, the frequency at which it will vibrate is etched on the side. Hit the fork on a soft surface (like the heel of your hand), not on something hard that could nick it. (The metal is somewhat soft and a nick will change the frequency.)

## Transparency

### Sound and Ear Damage

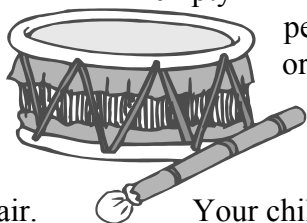
Type Of Sound	Decibel Level	Level Of Harm
Missile	180	DANGEROUS (Sounds of 140 or Higher may cause Pain)
Machine gun	160-170	
Jet in air	140-150	
Jet on ground	130	
Rock band	120	SERIOUS
Motorcycle	110	
Traffic	100	
Large truck	90	
Vacuum cleaner	80	MINOR
Ringing phone	70	
Loud yell	60	
Quiet restaurant	50	
Quiet talking	40	NONE
Empty school	30	
Whispering	20	
Normal breathing	10	

## Parent Directions for Making Instruments

Dear Parents:

We are studying sound in science class. One way in which children can demonstrate their understanding of sound is to make a musical instrument.

There are many ways to make instruments. In this exercise, children can be creative. The simplest kinds of instruments are percussion. Drums and cymbals are percussion instruments. If you have empty milk cartons, pails, or other containers, your child can make a percussion instrument. It can be decorated with permanent markers or other media.



vibrate the air.



Stringed instruments use rubber, string, or fabric to vibrate the air. Your child can make a stringed instrument with rubber bands, wires, or string. You can use a firm box (a shoe box or pencil box) as the base for a stringed instrument. Make some strings tight (to make high sounds) and some strings a little looser (to make low sounds.)

Wind instruments use long tubes to vibrate the air. Children can make music by blowing in something simple (like a paper towel tube) or can create a more complicated instrument using a PVC pipe. (An adult should drill the holes in PVC pipe.)

A good instrument makes a regular sound. improve the instrument design. Then give your child and improve the design. As you help your child make most important rule is to have fun. Music is not only important way for children to express themselves



Help your child test and the opportunity to test these instruments, the science—it's an creatively.

Thanks for your help.

**Rubric for listening to children's explanations of sound and**

<b>Criterion</b>		<b>Level</b>
<b>Basic Science</b>	<b>Child clearly explains that sound is a vibration in matter.</b>	<b>4</b>
	<b>Child explains that sound is a vibration in a fragmented way.</b>	<b>3</b>
	<b>Child implies understanding that sound is a vibration, but does not explain in words.</b>	<b>2</b>
	<b>No evidence that child understands that sound is a vibration.</b>	<b>1</b>
<b>Pitch</b>	<b>Child clearly explains that pitch is the frequency of vibration.</b>	<b>4</b>
	<b>Child explains that pitch is the frequency of vibration in a fragmented way.</b>	<b>3</b>
	<b>Child implies understanding that pitch is the frequency of vibration, but does not explain in words.</b>	<b>2</b>
	<b>No evidence that child understands that pitch is the frequency of vibration.</b>	<b>1</b>
<b>Volume</b>	<b>Child clearly explains that volume is the result of the amount of force (amplitude of vibration) in matter.</b>	<b>4</b>
	<b>Child explains that volume is the result of the amount of force (amplitude of vibration) in a fragmented way.</b>	<b>3</b>
	<b>Child implies understanding that volume is the result of the amount of force (amplitude of vibration), but does not explain in words.</b>	<b>2</b>
	<b>No evidence that child understands that volume is the result of the amount of force (amplitude of vibration).</b>	<b>1</b>